

SWRCB San Francisco Estuary low-salinity zone workshop

U.S. Fish and Wildlife Service

September 5, 2012

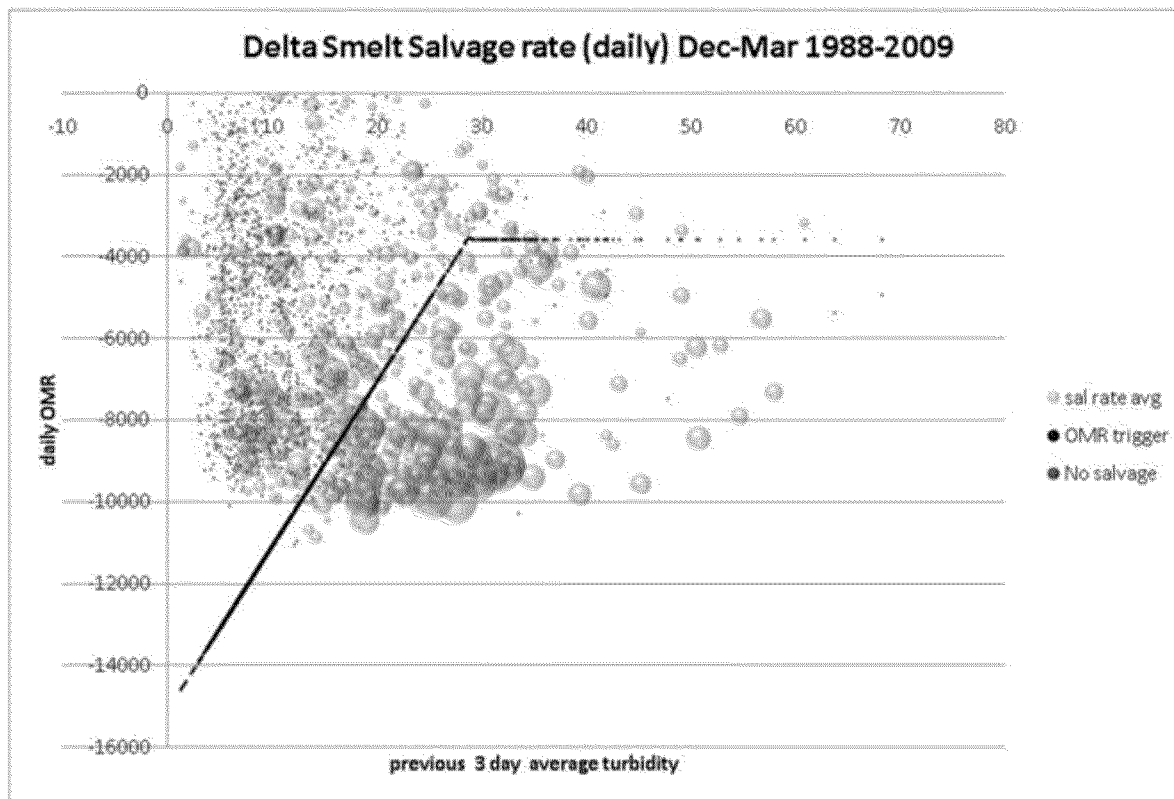
Key points

1. Please see April 2012 key points
2. We suggest the Board model a range of flow objectives that could be incorporated into the WQCP
3. OMR flows contribute to the entrainment risk of adult delta smelt
4. OMR flows drive entrainment of larval delta smelt
5. Multiple factors have contributed to the long-term degradation of the LSZ. However, Delta outflow is still an extremely important aspect of habitat suitability for delta smelt

Adult entrainment

- Adult delta smelt get salvaged during spawning migrations
 - Salvage \neq entrainment
 - Entrainment is 'caused' by a combination of factors
 - Smelt use Delta hydrodynamics to help them get to staging habitats
 - Project ops influence Delta hydrodynamics and thus entrainment risk
 - Some spawning occurs in the SJ River
 - The entrained fish have not spawned

High adult delta smelt salvage tends to happen in association with negative OMR flows and high turbidity



Source: Declaration of Dr. Richard Deriso

The OMR flow-turbidity combinations that appear to prevent high salvage depend on the time scale the data are averaged over

Time step (days)	Starting OMR (cfs)	Turbidity threshold (NTU)		Alternative OMR	
1	-3000	Until	13	Then	-1900
7	-5200	Until	23	Then	-1900
14	-3300	Until	25	Then	-2500
24	-4600	Until	29	Then	-3600
28-31	-4200	Until	No threshold	Then	-4200

Source: USFWS unpublished data analysis

Modeling methods basically agree about drivers and magnitude of larval delta smelt entrainment

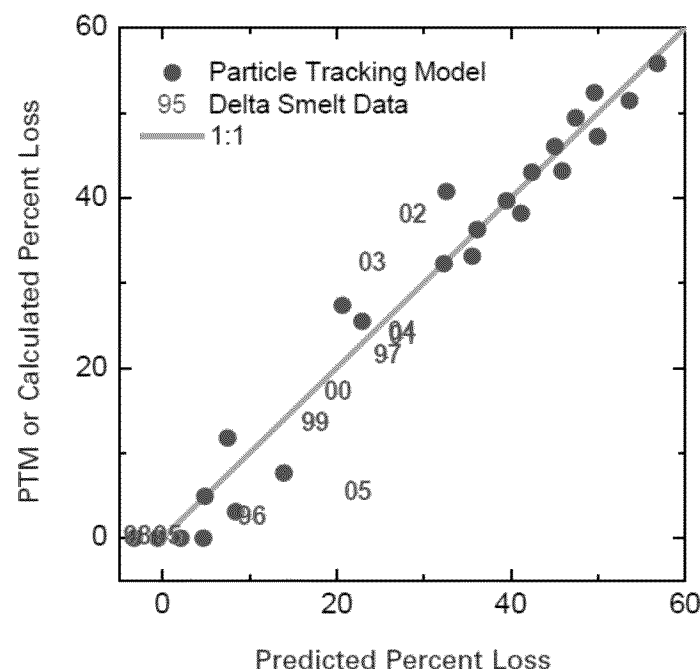
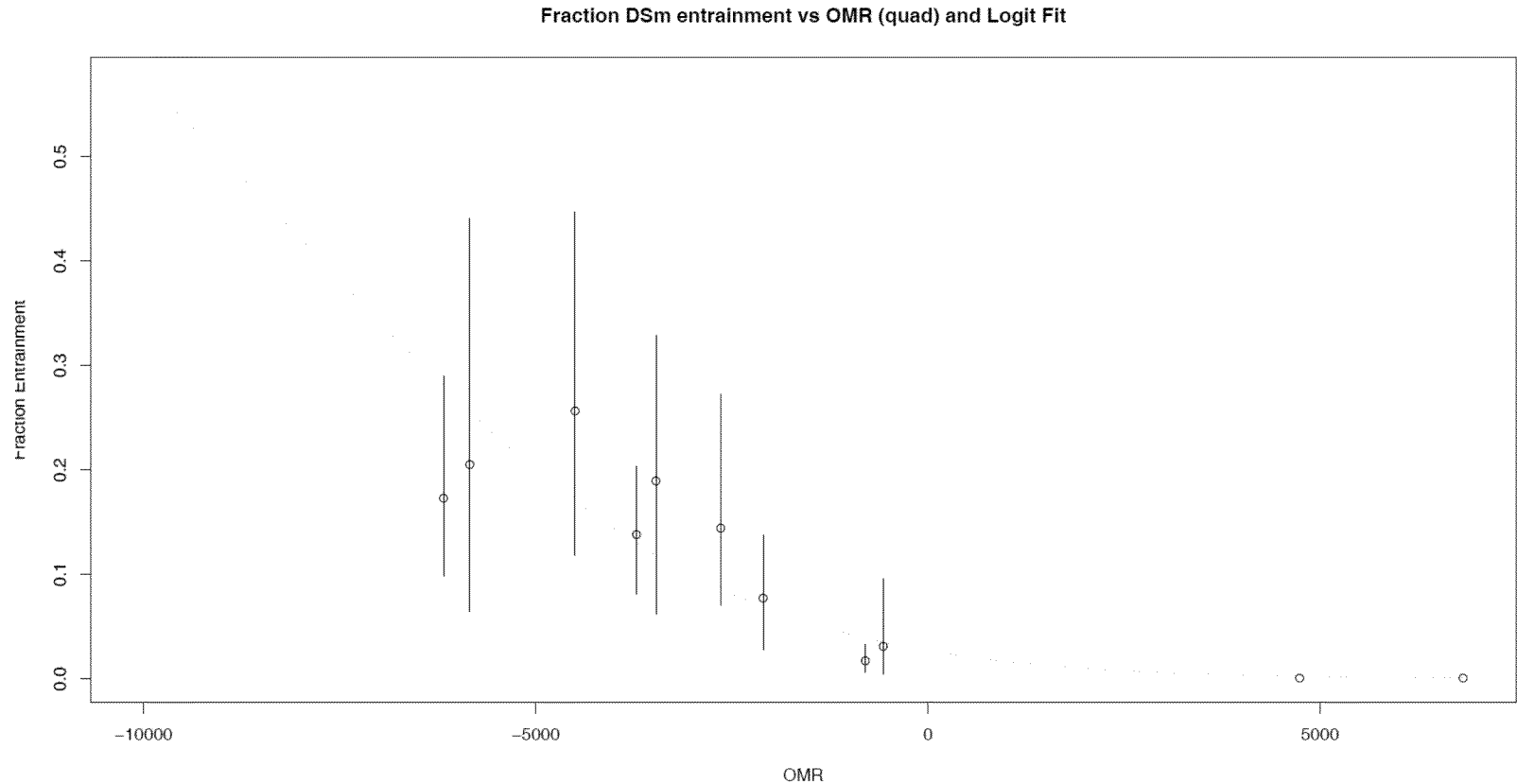


Figure 16. Larval/juvenile delta smelt. Predicted percent loss to the population by regression using log of Delta inflow and log of export flow as predictors (with interaction), and particle-tracking model results as the dependent variable (circles), with the line indicating a 1:1 relationship. The regression is:

Source: Kimmerer (2008) San Francisco Estuary and Watershed Science

...and OMR is (or indexes) the driver very well



Source: USFWS unpublished data analysis

When carrying capacity isn't exceeded, entrainment can contribute to decline

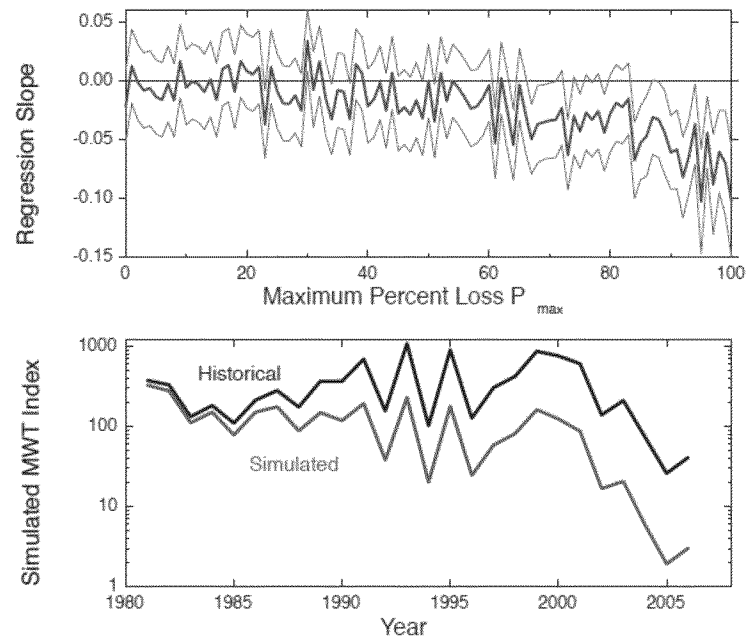
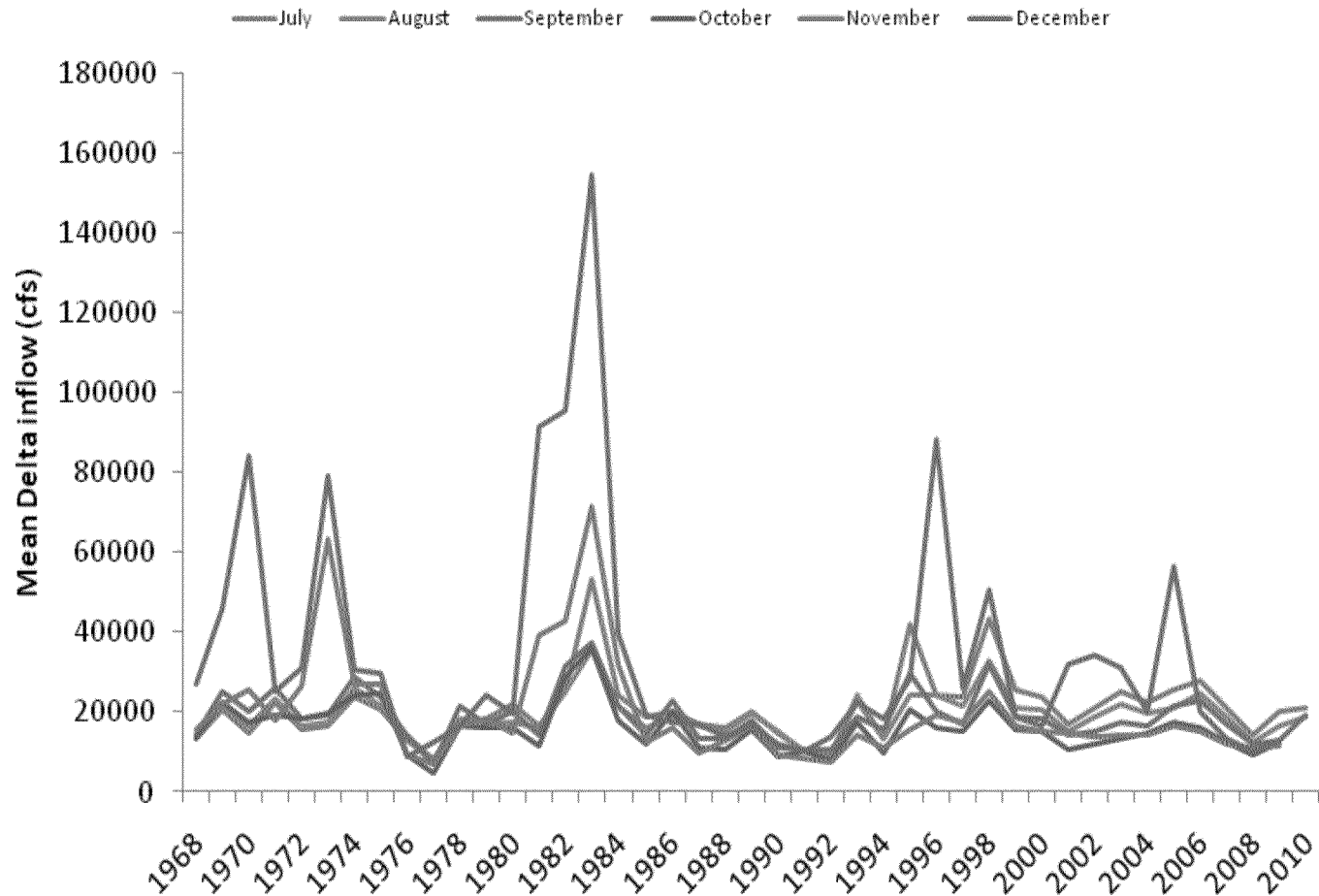


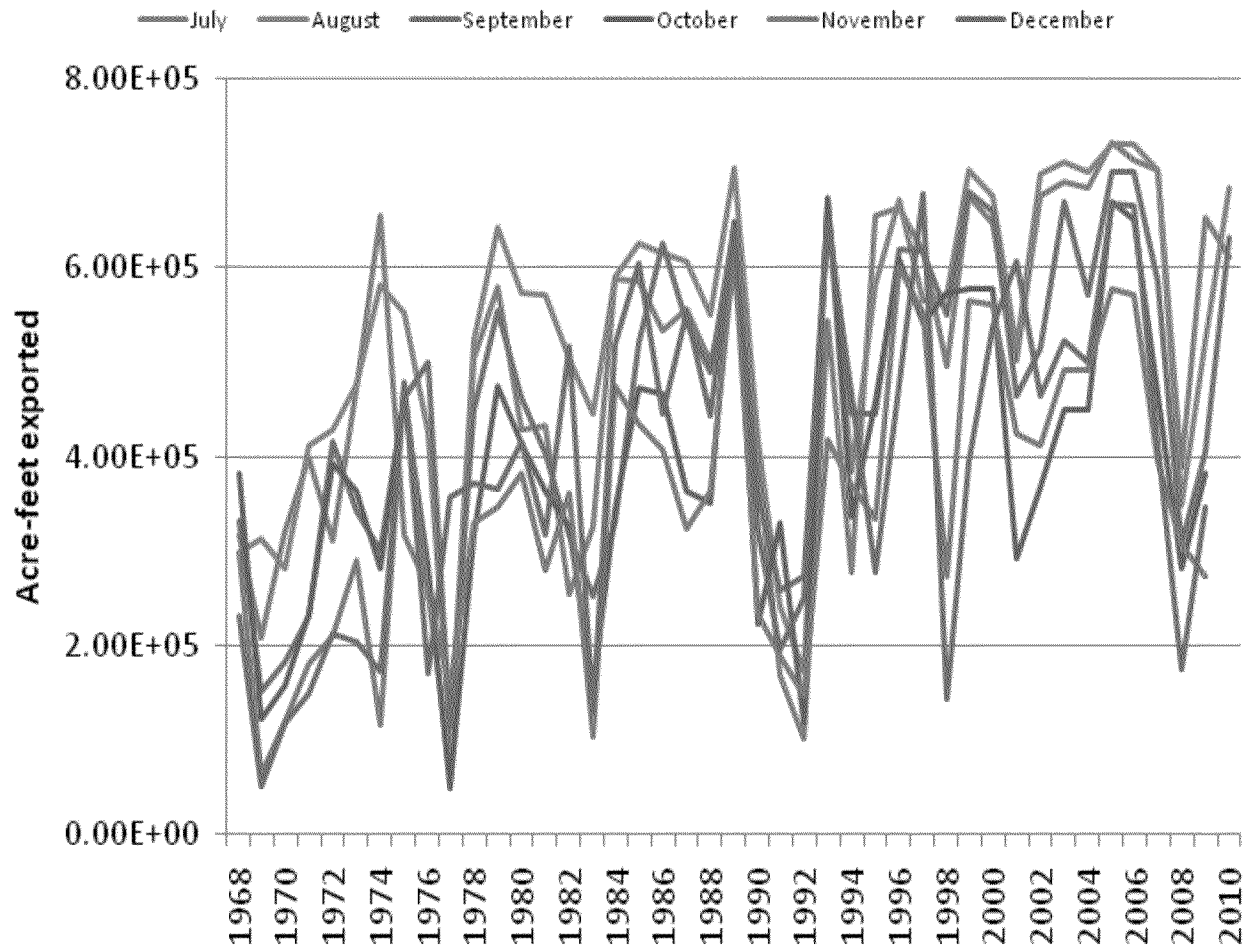
Figure 3 Results of simulation of ability to detect export loss through regression analysis. Upper panel: individual simulation results giving the slope (thick blue line) and 95% confidence limits (thin red lines) for regressions of the stock-recruit index on southward OMR flow. Lower panel: trajectory of the fall midwater trawl index (upper line) and the same index with a 20% P_{\max} value imposed for the entire time series (mean $P_L \sim 10\%$). This is for illustration only (see text), and does not imply anything about the cause of the decline in delta smelt.

Source: Kimmerer (2011) San Francisco Estuary and Watershed Science

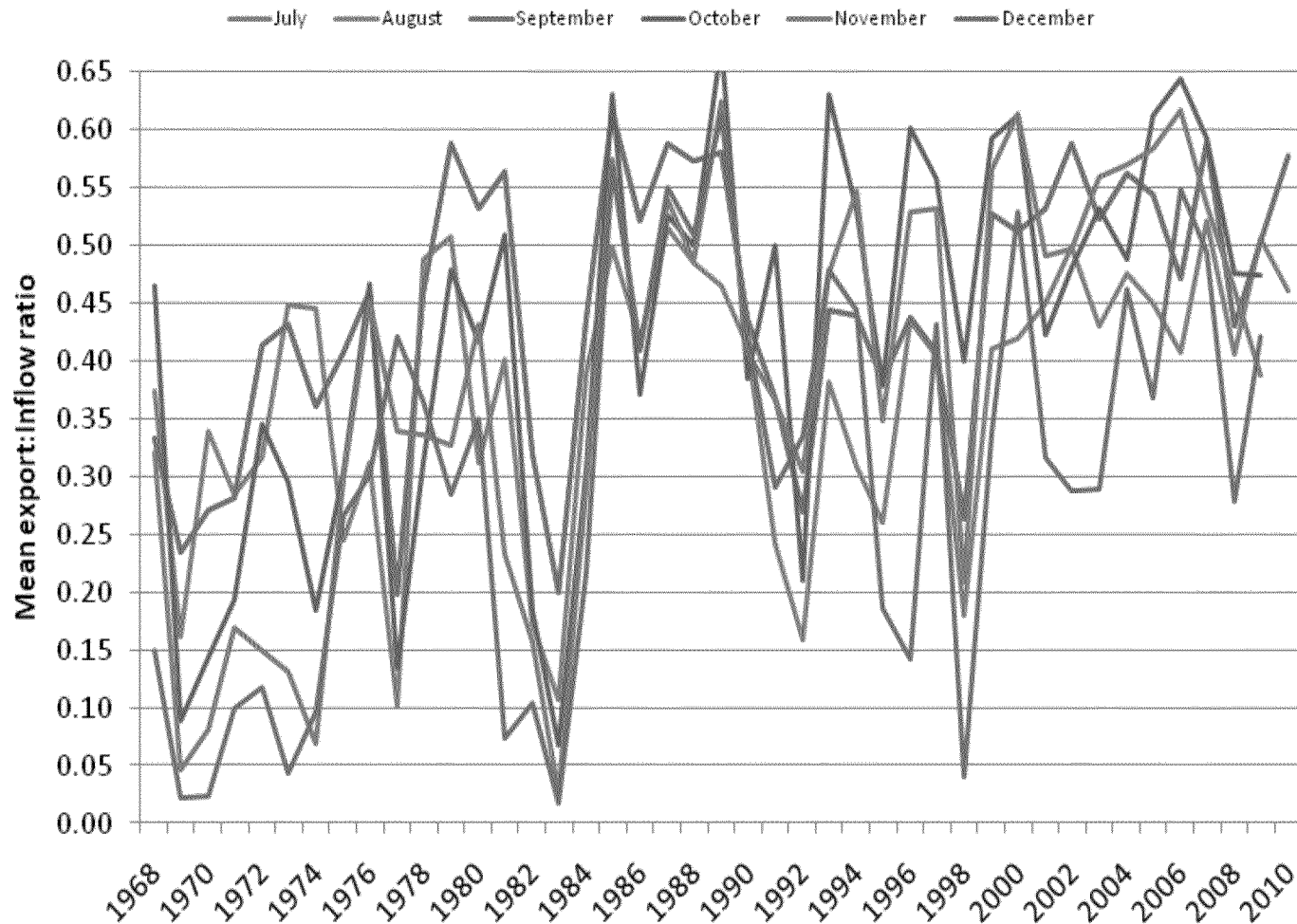
Time series of summer-fall Delta inflow



Time series of summer-fall exports



Time series of summer-fall E:I ratios



Feyrer et al. (2011)

- Fall habitat suitability has declined
- Fall habitat suitability is closely, but nonlinearly related to X2
- Fall habitat suitability correlated with abundance

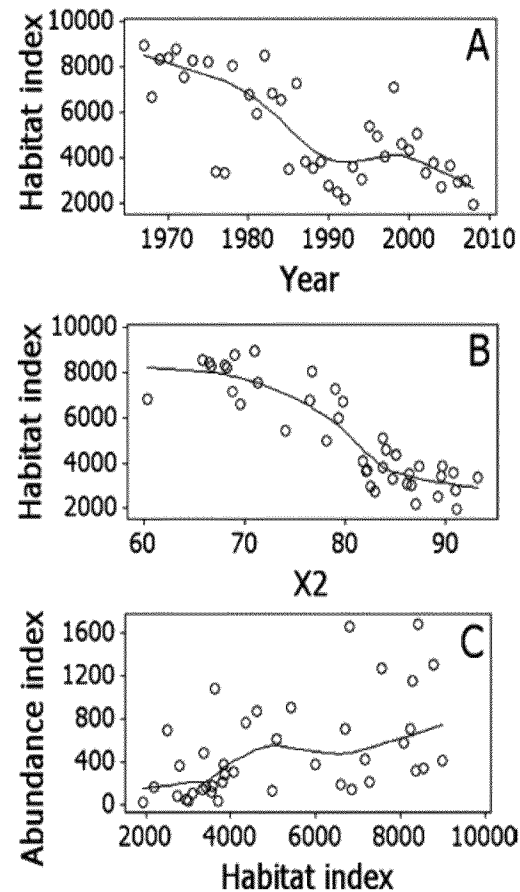


Fig. 2 Plots of the habitat index time series (a), relationship between X_2 (km) and the habitat index (b), and relationship between the habitat index and delta smelt abundance measured as the fall midwater trawl index. Curves are LOESS smooths

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